

from the DEA to grow cannabis for use in clinical research. After years of prevarication, and pressure on the DEA to make a decision, Dr Craker's application was turned down in 2004. Today, the saga continues and a DEA judge (who presides over a quasi-judicial process within the agency) is hearing an appeal, which could come to a close this summer. Dr Craker says that his situation is like that described in Joseph Heller's novel, "Catch 22". "We can say that this has no medical benefit because no tests have been done, and then we refuse to let you do any tests. The US has gotten into a bind, it has made cannabis out to be such a villain that people blindly say 'no'."

Anjali Verma, the advocacy director of the American Civil Liberties Union (ACLU), a group helping Dr Craker fight his appeal, says that even if the DEA judge rules in their favour, the agency's chief administrator can still decide whether to allow the application. And, as she points out, the DEA is a political organisation charged with enforcing the drug laws. So, she says, the ACLU is in this for the long haul, and is already prepared for another appeal—one that would be heard in a federal court in the normal judicial system.

Ms Verma's view of the FDA's statement is that other arms of government are putting pressure on the agency to make a public pronouncement that conforms with drug ideology as promulgated by the White House, the DEA and a number of vocal anti-cannabis congressmen. In particular, the federal government has been rattled in recent years by the fact that eleven states have passed laws allowing the medical use of marijuana. In this context it is notable that the FDA's statement emphasises that it is smoked marijuana which has not gone through the process necessary to make it a prescription drug. (Nor would it be likely to, with all of the harmful things in the smoke.) The statement's emphasis on smoked marijuana is important because it leaves the door open for the agency to approve other methods of delivery.

High hopes

Donald Abrams, a professor of clinical medicine at the University of California, San Francisco, has been working on one such option. He is allowed by the National Institute on Drug Abuse (the only legal supplier of cannabis in the United States) to do research on a German nebuliser that heats cannabis to the point of vaporisation, where it releases its cannabinoids without any of the smoke of a spliff, and with fewer carcinogens.

That is encouraging. But it does not address the wider question of which cannabinoids are doing what. For that, researchers need to be able to do their own plant-breeding programmes.

In America, this is impossible. But it is happening in other countries. In 1997, for example, the British government asked Geoffrey Guy, the executive chairman and founder of GW Pharmaceuticals, to come up with a programme to develop cannabis into a pharmaceutical product.

In the intervening years, GW has assembled a "library" of more than 300 varieties of cannabis, and obtained plant-breeder's rights on between 30 and 40 of these. It has found the genes that control cannabinoid production and can specify within strict limits the seven or eight cannabinoids it is most interested in. And it knows how to crossbreed its strains to get the mixtures it wants.

Nor is this knowledge merely academic. Last year, GW gained approval in Canada for the use of its first drug, Sativex, which is an extract of cannabis sprayed under the tongue that is designed for the

relief of neuropathic pain in multiple sclerosis. Sativex is also available to a more limited degree in Spain and Britain, and is in clinical trials for other uses, such as relieving the pain of rheumatoid arthritis.

At the start of this year, the company made the first step towards gaining regulatory approval for Sativex in America when the FDA accepted it as a legitimate candidate for clinical trials. But there is still a long way to go.

And that delay raises an important point. Once available, a well-formulated and scientifically tested drug should knock a herbal medicine into a cocked hat. No one would argue for chewing willow bark when aspirin is available. But, in the meantime, there is unmet medical need that, as the IOM report pointed out, could easily and cheaply be met—if the American government cared more about suffering and less about posturing. ■



Particle physics

The collider calamity

A report on the state of fundamental physics in America

NEAR Waxahachie in Texas, there is a hole in the ground. Not just any old hole. This one is almost 23km long and curves in what would be, if it were extended, a circular loop. It is the site of what was intended to be the world's biggest and best particle accelerator, a machine capable of unlocking some of the fundamental secrets of nature itself. Ever since the project to build it was cancelled in 1993, after nearly \$2 billion had been spent on construction, America's lead in particle physics has been shrinking. This week, a report

by the country's National Research Council (NRC) outlined what America can do to regain its pre-eminence.

The outlook is grim. After decades of making discoveries about the fundamental building blocks of nature, America's particle-physics colliders are to close. The Tevatron at Fermilab, near Chicago, is the world's highest-energy particle-smasher. But that honour will be wrenched from it next year, when the Large Hadron Collider (LHC) opens for business at CERN, the European particle- ▶▶

► physics laboratory near Geneva. The Tevatron is scheduled to shut by the end of the decade, and the LHC is expected to dominate international particle physics for the next 15 years.

America's other accelerators are in trouble, too. Work at the Stanford Linear Accelerator Centre is moving away from particle physics and into generating high-energy x-rays. Funding for the Relativistic Heavy Ion Collider at the Brookhaven National Laboratory is so tight that the machine managed to keep running only after a philanthropist intervened. Many American particle physicists have switched their attentions to the LHC. And while physicists dream of shiny new machines, none is scheduled to be built in America. In the review of its top ten research advances of 2005, *Science* singled out American particle physics for the booby prize.

This is a shame. While particle physics does not produce economic returns in the lifetimes of the administrations that fund the experiments, it is a fascinating endeavour. Over the past 100 years, physicists have succeeded in identifying the fundamental building blocks of the universe, both in terms of matter and of the forces that act on it. Yet the so-called Standard Model of particle physics, which weaves these discoveries together, and which has proved so successful to date, is incomplete. If physicists are to improve on it, they need machines that supply particles at higher energies to probe the nature of space and time. Such machines could provide answers about how the universe began and how it will evolve.

In this light, the NRC report makes interesting if somewhat biased reading. It wants America to retake the lead in particle physics, and to host the next new particle accelerator to be built after the LHC. A decision on whether to build this machine, dubbed the International Linear Collider, will not be taken until the initial results from the LHC are known. If these point to more fundamental physics beyond the Standard Model, as is widely expected, then there would be mileage in building a more powerful accelerator to study these phenomena. Such a decision would not be made until 2010, but America's physicists are keen for their country to host such a facility.

To do so, the NRC reckons, America will need to spend between 2% and 3% more each year in real terms on particle physics. That might not sound onerous, but it amounts to \$500m over the next five years.

European particle physicists are also keen to lead the world. A similar panel of experts is close to finalising a European strategy. The CERN Council Strategy Group, as it is called, will meet near Berlin next week to hammer out a consensus. Then, in July, this consensus will be presented to the politicians who decide the

funding of particle physics.

At present, Europe is poised to take the lead: it will soon have the world's biggest and best particle accelerator. Whether CERN could afford to host the International Linear Collider, though, is a moot point. The laboratory has had to take out loans to build the LHC, and it is likely that any future money would be spent on upgrading that machine.

Then there is Japan, which has a promising programme in neutrino physics, another area where the report urges America to push forwards. Japan recently lost the fight to host the International Thermo-

nuclear Experimental Reactor, an expensive international project which aims to demonstrate that nuclear fusion could produce power on a commercial basis, so it feels it is owed something. And, depending on the strengths of their economies when the time comes to make the decision, Russia, China and India could all be interested, too.

In any event, American particle physics looks set for a period in the wilderness. Whether the country can recapture its superiority after such a spell depends on whether there is the political will to pour more money into holes in the ground. ■

AIDS

Bitter fruit

Another idea for stopping AIDS falls flat

LIME juice is famous in medical history. Sailors—particularly British sailors—drank it to keep scurvy at bay. But the past few years have seen another use mooted. This is that, if applied to the vagina, it might protect a woman from HIV infection, and thus from AIDS. On April 24th a group of researchers met at the Microbicides 2006 conference in Cape Town to discuss the matter.

Though a lime-juice douche sounds a ghastly idea, women have been putting acids into their vaginas for millennia, in the hope of preventing pregnancy and sexually transmitted diseases. Indeed, cleaning with lime juice is common practice in parts of Africa. Of 200 prostitutes surveyed in 2004 in the Nigerian city of Jos, 163 said they rinsed with lemon or lime juice before or after sex to prevent pregnancy and infections. The question is, are they sensible to do so?

Acids immobilise sperm and kill pathogens, including HIV. (Laboratory studies have shown that a one-in-five dilution of lemon or lime juice inactivated 90% of HIV in just two minutes.) And, in addition to its high citric-acid content, lime juice has a second attractive feature: it literally grows on trees.

However, there is also the matter of the damage that citric acid causes to the vaginal lining. Two studies, one carried out by Carol Lackman-Smith of the Southern Research Institute in Frederick, Maryland, and the other by Christine Mauck of CONRAD (an American contraceptive research and development programme), have shown that anything more concentrated than a one-to-one dilution of lemon juice would damage the cells that line the vagina. Such damage would make it easier, rather than harder, for HIV to get into the bloodstream.

Given the success in the laboratory of



A fruitless hope

a one-in-five dilution, that does not sound an insuperable objection. But there is a second problem. In the bedroom, seminal fluid is also involved in the mix. And seminal fluid is alkaline. The need to overcome this alkalinity means it takes at least a 50% solution of lime juice to inactivate the virus during real sexual intercourse. The upshot is that, as a microbicide, lime juice is safe when it is ineffective, and effective when it is unsafe. Which leaves the small matter of the women in Jos, and the many others who use similar methods. They need to be told that in seeking protection, they may, in fact, be putting themselves at greater risk.